

Australian/New Zealand Standard™

Bunk beds



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STANDARDS
NEW ZEALAND
Paeonua Aotearoa

AS/NZS 4220:2003

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Australian Chamber of Commerce and Industry
Australian Competition and Consumer Commission
Australian Consumers Association
Australian Industry Group
Australian Retailers Association
Barnardos New Zealand
Commercial Furniture Industry Association of Australia
Competition and Consumer Policy Division, Department of The Treasury
Consumer Affairs Victoria
Consumers Federation of Australia
Department of Consumer and Employment Protection, WA
Department of Human Services, SA
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Australian/New Zealand Standard™

Bunk beds

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CS-003, Safety Requirements for Children's Furniture, following concern expressed by the South Australian Department of Human Services and Departments of Fair Trading about the number and severity of injuries suffered by children falling from or otherwise injured by bunk beds. This Standard supersedes AS/NZS 4220:1994.

The objective of this Standard is to provide regulatory authorities with safety requirements and to provide manufacturers with functional, durability, stability and performance criteria to meet these safety requirements, in order to reduce the likelihood of deaths or injuries to children.

The term 'normative' has been used in this Standard to define the application of the appendix to which it applies. A 'normative' appendix is an integral part of a Standard.

The Committee considered raising the minimum vertical distance between the upper surface of the guardrail and the upper surface of the mattress base to a minimum of 360 mm from 260 mm in this version of the Standard. However it was decided that further stakeholder consultation is required. This will be considered at the next revision of this Standard.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Bunk beds**

1 SCOPE

This Standard specifies safety requirements for bunk beds. These include material, construction, design, and performance requirements, all of which are important for the well-being of the users (especially children) of bunk beds.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

2281 Flexible cellular polyurethane for seat cushioning and bedding

AS/NZS ISO

8124 Safety of toys

8124.1 Part 1: Safety aspects related to mechanical and physical properties
(ISO 8124-1:2000, MOD)

8124.3 Part 3: Migration of certain elements

3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

3.1 Bunk bed

Either—

- (a) a set of components that are or can be assembled as beds, one stacked over the other (see Figure 1); or
- (b) any bed, other than a hospital bed in which the upper surface of any mattress base is at least 800 mm above the floor surface.

3.2 End rail

A lateral component, fastened between a pair of structural uprights.

3.3 Gap

An opening bounded either by solid components of a bunk bed (see A in Figure 2) or by solid components of the bunk bed and a straight imaginary boundary joining solid components in such a manner as to result in a maximum bounded area (see B in Figure 2).

3.4 Grip

A component with a circumference that allows a hand to hold and close around its entire circumference (see Figure 3).

NOTE: The maximum single grip width is 45 mm.

3.5 Guardrail

A component of the bunk bed intended to prevent an occupant from falling off the bed.

3.6 Hazardous sharp edge

An edge which fails the appropriate test specified in Clause 6.7.

3.7 Hazardous sharp point

A point which fails the appropriate test specified in Clause 6.7.

3.8 Mattress base

The surface on which the mattress is supported.

3.9 Side rail

A longitudinal component, fastened between a pair of structural uprights (e.g. corner posts) by which the mattress base may be supported.

3.10 Structural uprights

Components to which other components such as the end and side rails are fastened to form a rigid structure. The structural uprights are intended to support the mass of the bunk bed and its contents (including the occupants).

NOTE: A common type of structural upright is the corner post as shown in Figure 1.

3.11 Tread

A step or rung of a ladder or other structures designed for climbing.

4 MATERIALS

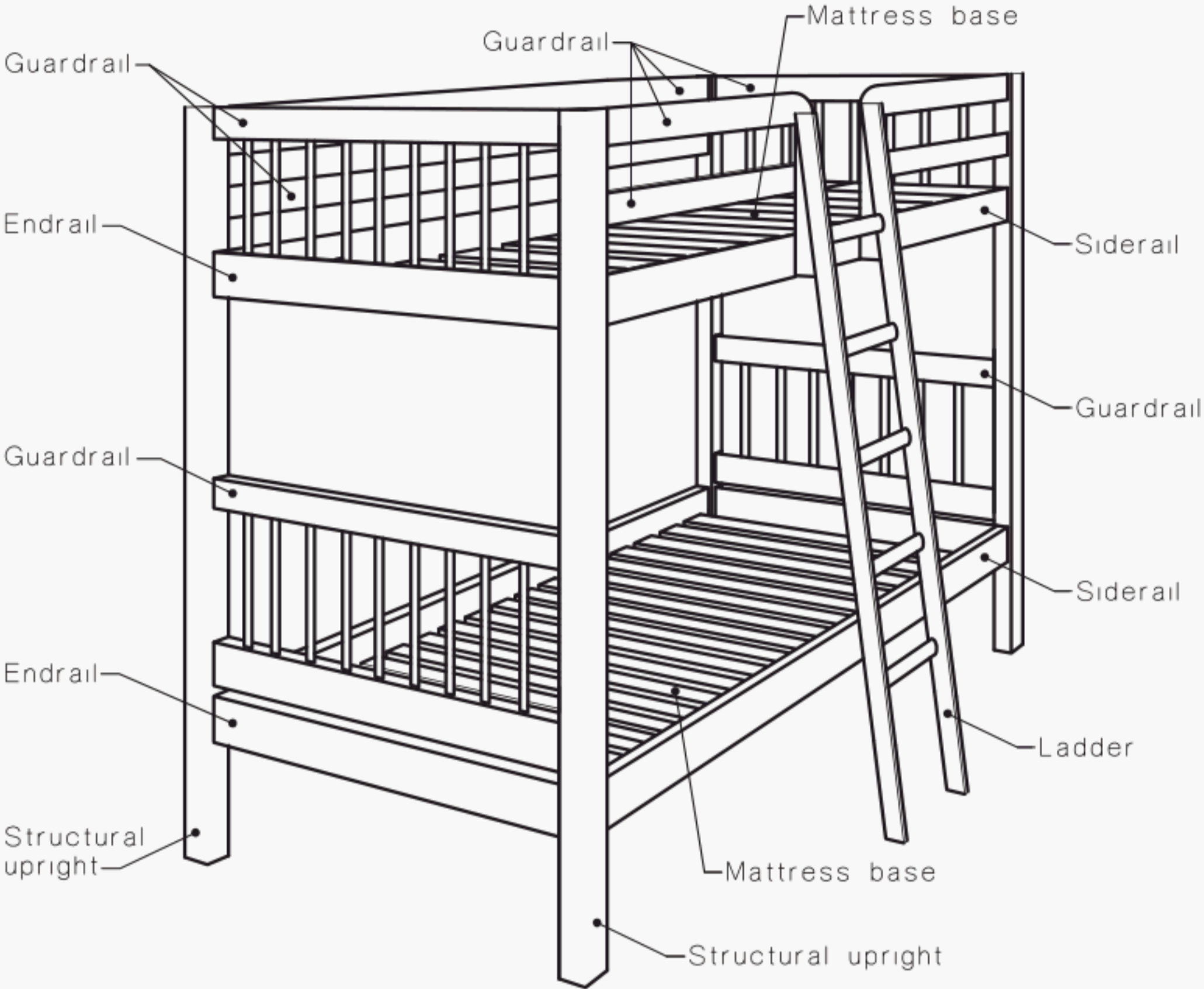
4.1 Timber

Timber used in bunk beds shall not contain splinters or loose knots and shall be free from decay and insect attack which would affect its safe handling or structural integrity.

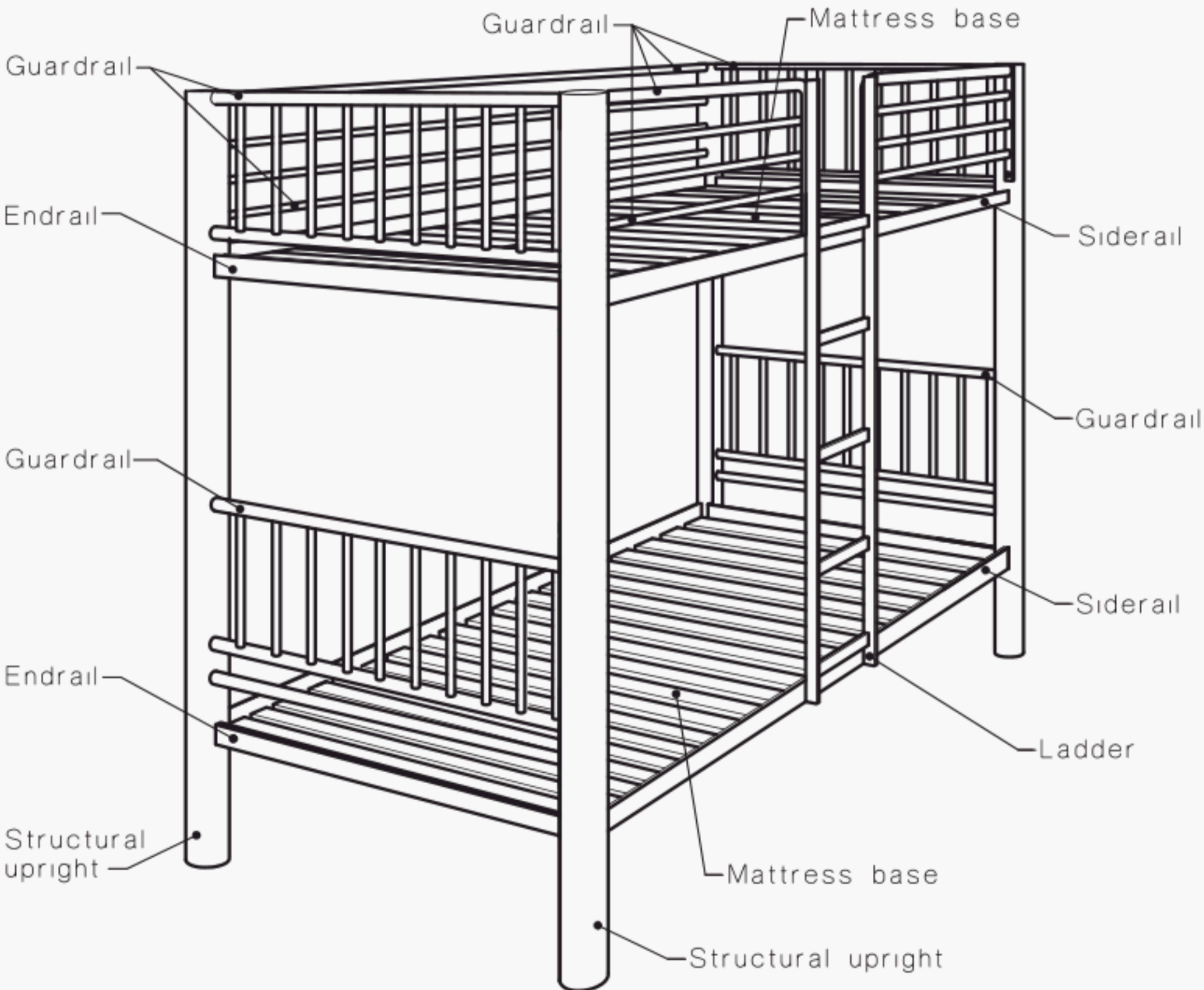
NOTE: It is recommended that the moisture content not exceed 13%. High moisture content can cause adhesive failure and excessive shrinkage which would affect the structural integrity of the bunk.

4.2 Metals

All exposed metal components, including springs, nuts, bolts, and washers, shall be either made of corrosion-resistant material or be protected against corrosion.



(a) An example of a timber bunk bed



(b) An example of a metal bunk bed

FIGURE 1 BUNK BEDS

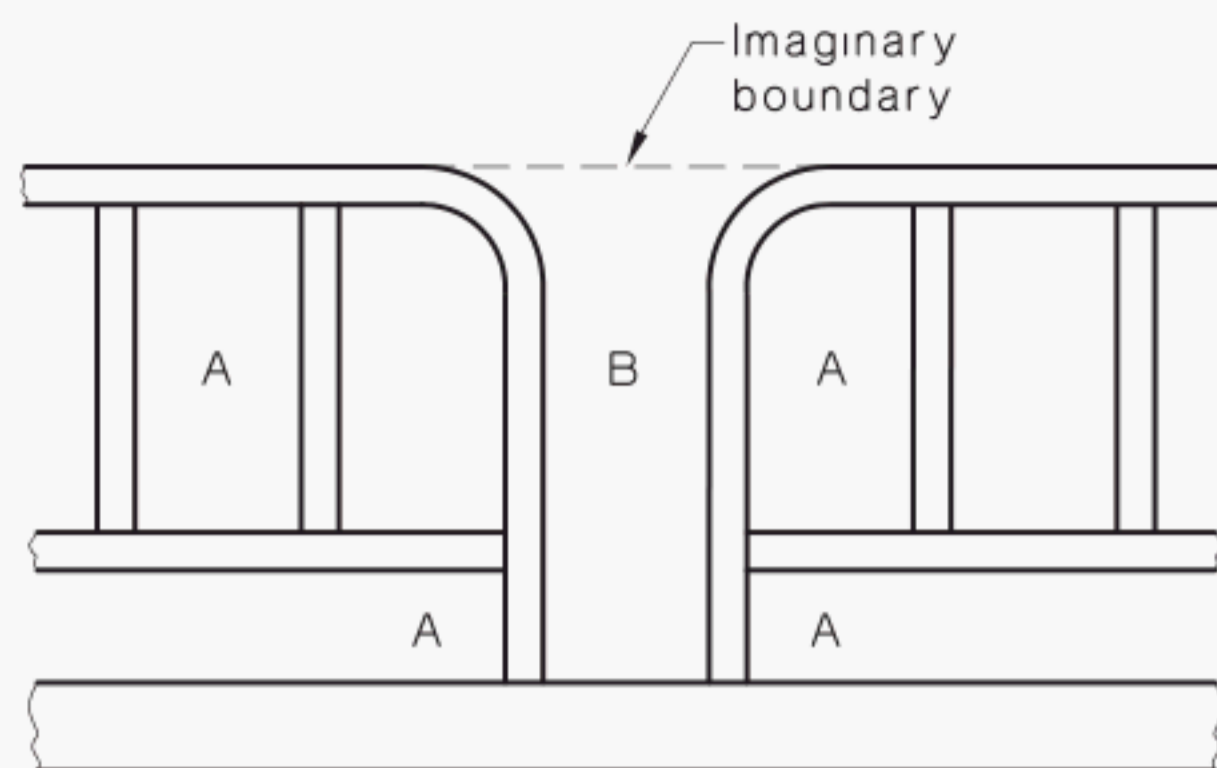


FIGURE 2 TYPICAL GAPS (see Clause 3.3)

4.3 Coatings and plastics components

All coatings and plastics components shall comply with the relevant toxicological requirements specified in AS/NZS ISO 8124.3.

5 CONSTRUCTION

5.1 General

All components of the bunk bed intended by the manufacturer to remain permanently fixed shall be fastened so that they either cannot be disassembled or they require the use of a tool to enable partial or total disassembly. All joints shall be close fitting. Welds where present, shall be smooth and free from flux, slag and spatter.

5.2 Fasteners

All fasteners (e.g. screws, nails, dowels, nuts, bolts) shall be fastened so that they are flush, recessed or suitably finished, relative to all components of the bunk bed, and do not present a sharp point, sharp edge or snag hazard.

6 DESIGN

6.1 Maximum height

The maximum height of a bunk bed having—

- (a) an upper bed suspended over a lower bed shall not exceed 1350 mm, as measured by the vertical distance between the floor and the upper surface of the mattress base; or
- (b) an elevated bed suspended over a play area, furniture (e.g. a workstation) or other feature, shall not exceed 1450 mm, as measured by the vertical distance between the floor and the upper surface of the mattress base.

NOTES:

- 1 Although it was recognized that increasing the permissible height of a bunk bed increases the risk of serious injury, the increased height in Item (b) was allowed because these types of bunks are intended for the older child (see Clause 8(c)) where the fall-out hazard is reduced. The increased height was considered necessary to enable the space below the elevated bed to be functional bearing in mind the height of the older child.
- 2 Designers are encouraged to keep the overall height as low as possible.

6.2 Minimum distance between beds

Where a bunk bed has an upper bed suspended over the lower bed so that their mattress bases are in parallel alignment, the vertical distance between the upper surface of the lower mattress base and the lower surface of the upper mattress base shall be at least 750 mm.

NOTE: This requirement does not apply if the mattress bases are above one another but transversely aligned.

6.3 Mattress support elements (mattress base components)

All components of the bunk bed which are used to support or constrain a mattress shall be so fixed that they shall not be capable of lateral or vertical movement by more than 5 mm from their intended positions at joints or fixing points under the application of a force of 500 N.

NOTE: The purpose of this requirement is to ensure that mattress supports such as slats cannot be slid or lifted out of place.

6.4 Safety barriers

6.4.1 General

Any bunk bed in which the upper surface of the mattress base is at least 800 mm from the floor shall have barriers (e.g. guardrails or bed ends) which form a roll-out protection on all sides of the bed.

6.4.2 Guardrails

The following requirements and recommendations apply to guardrails:

- (a) The guardrails may be permanently fixed to the bunk bed structure or attached in such a manner as to allow temporary removal and replacement. If a guardrail is detachable, it shall be incapable of removal by a force of 500 N applied to the guardrail in any direction.

NOTE: Although the above requirement is intended to ensure that a child cannot easily detach the guardrail, it does not infer that it cannot be easily detached by an adult. For example, the guardrail could be attached by two fastening devices which require simultaneous operation to detach it. The fastening devices could then be spaced an adult's arm span apart, in order to prevent a child detaching the guardrail. Alternatively, the fastening device could be so positioned that it is inaccessible to a child.

If fastening devices are used, it is recommended that the minimum force or torque required to operate the devices should be as follows:

- (i) push or pull force.....70 N.
- (ii) hand-hold twist.....2 Nm.
- (iii) finger and thumb twist0.5 Nm.

- (b) The following apply to openings in the guardrail:

- (i) At least one opening shall be provided for climbing access to the bed and be located above a ladder. Climbing access openings shall comply with Clause 6.5. Climbing access openings shall have a minimum width of 300 mm at the height of the 'max. mattress height' mark or alternatively be 200 mm above the mattress base with a maximum width of 400 mm measured 260 mm above the mattress base (see Figure 4).

At least one side of any climbing access opening shall have a grip of no more than 45 mm (see Figure 3).

- (ii) On either side of an access opening, the guardrail shall attain its full height within a distance of not more than 200 mm horizontally from the point of minimum width of the access opening (see Figure 4).

NOTE: Additional access openings may be provided for entry or servicing the bunk bed. Because such access represent discontinuities in the guardrails and reduce the effectiveness of roll-out protection, the number of such openings should be kept to a minimum. The maximum should be 5 allowing for 2 per side rail and only 1 per both end rails.

- (c) There are two options for the minimum vertical distance between the upper surface of the guardrail and the upper surface of the mattress base, viz. either—

- (i) the minimum distance shall not be less than 360 mm (see Figure 4); or
- (ii) the minimum distance shall be less than 360 mm, but not less than 260 mm and the manufacturer shall provide a permanent marker in accordance with Clause 9(a) indicating the maximum allowable height of the mattress which shall be at least 160 mm below the upper surface of the guardrail (see Figure 4 and 5).

NOTE: Clause 9(a) requires that a line plus text be drawn on at least one side or end of the bunk bed which indicates the maximum height of the mattress if the guardrail is less than 360 mm high.

- (d) When tested in accordance with the appropriate steps in Appendix A, except those gaps allowed by Clause 6.4.2(b), any gap formed within the guardrail itself may allow the passage of the 230 mm diameter probe, but shall not be so large as to provide an opening that is more than 400 mm measured in any direction (see Figure 6). If any gap allows the passage of a 230 mm diameter probe, that gap shall not be of such a design that it has a reducing configuration (e.g. see Figure A1).

NOTES:

- 1 This requirement is intended to prevent a fall-through hazard.
- 2 See Clause 7.1 for entrapment hazards.

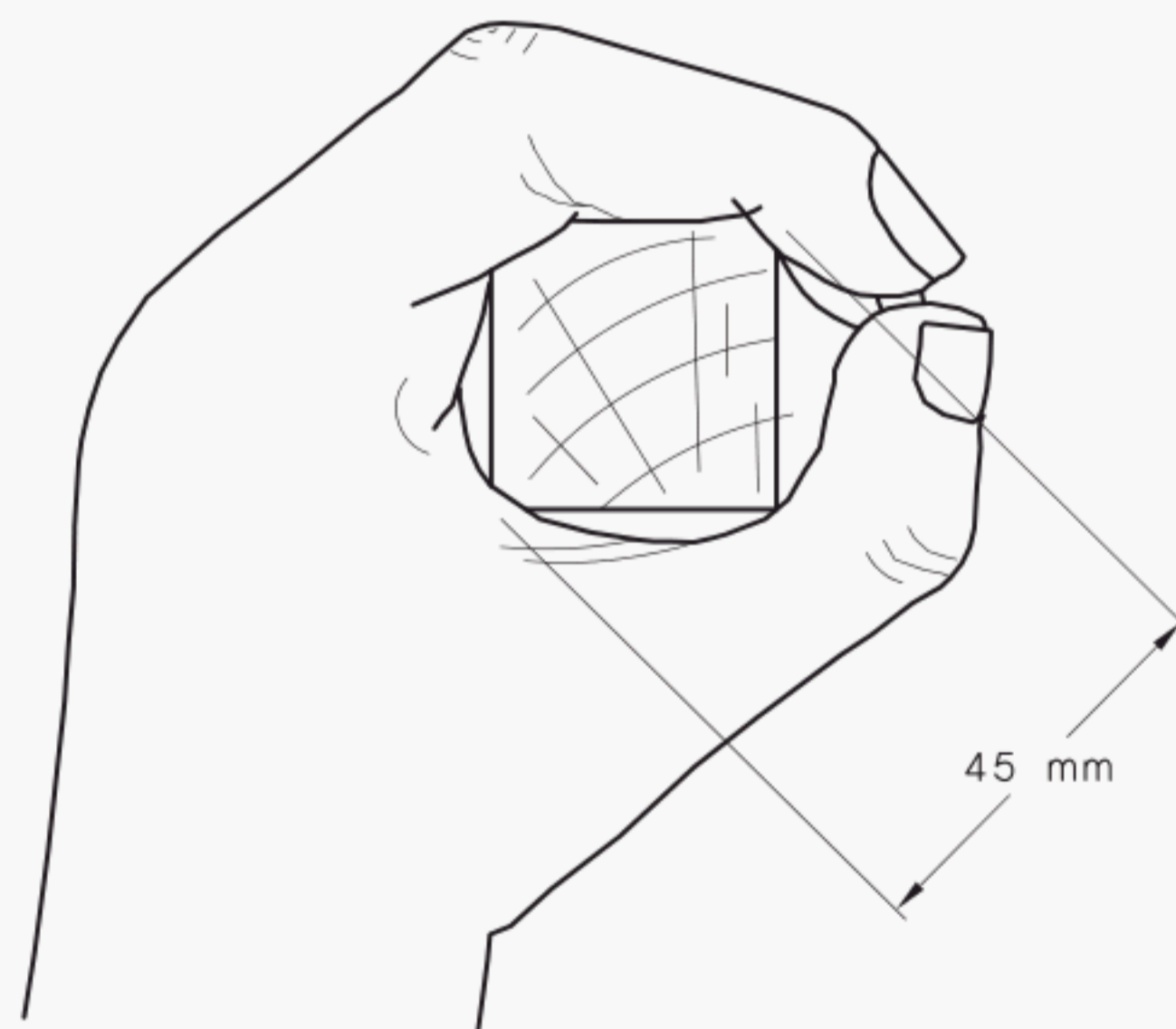
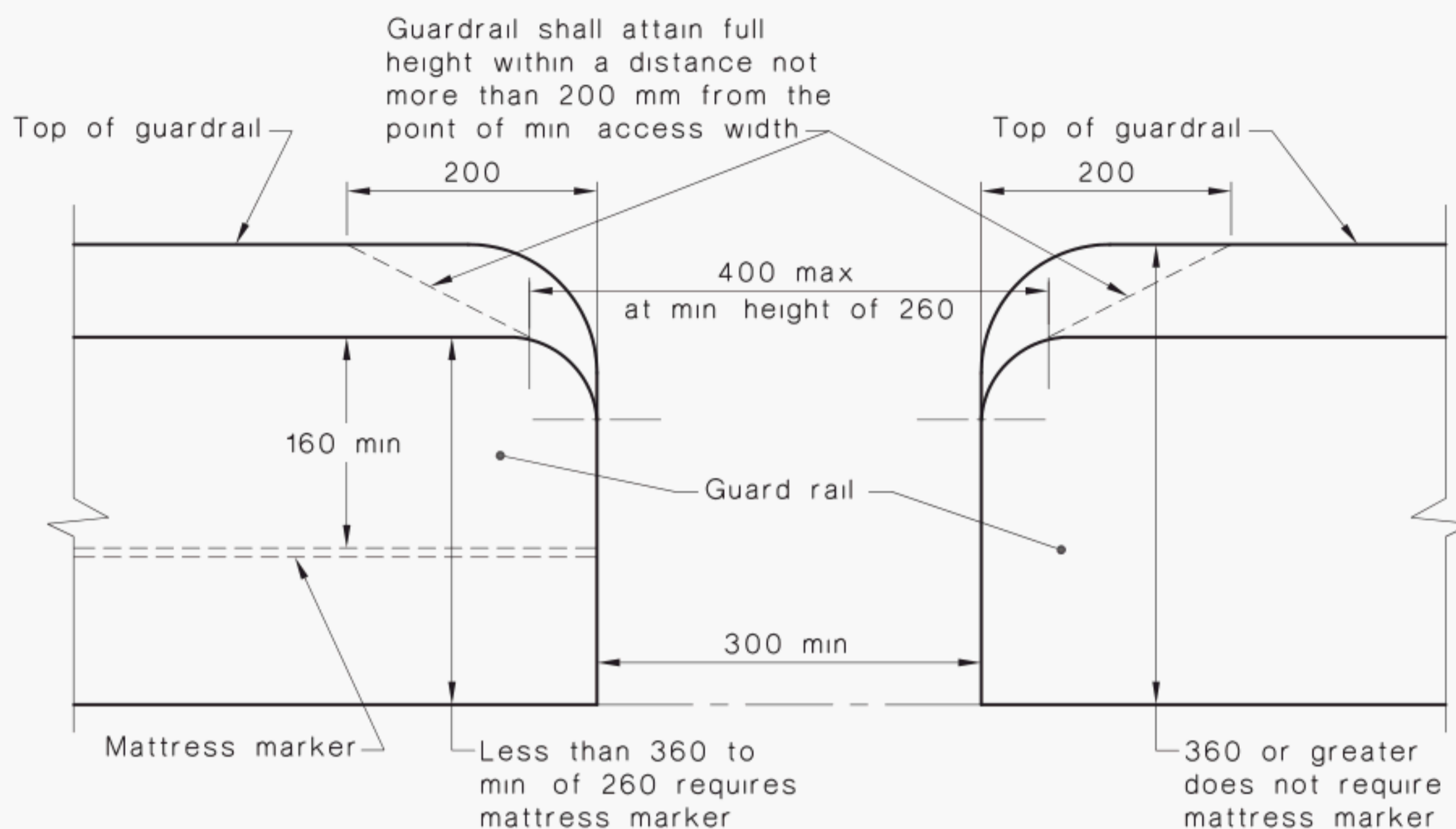
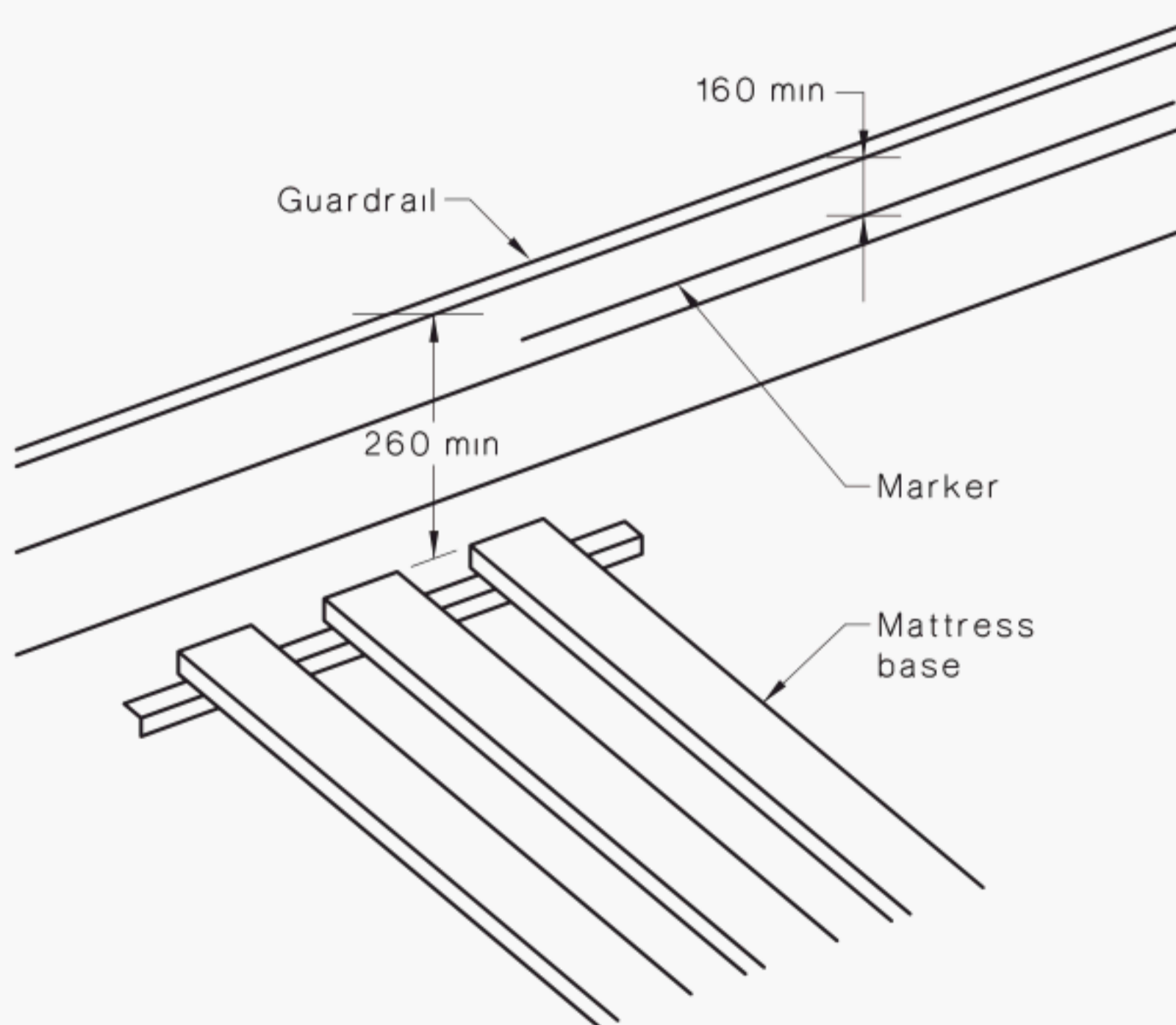


FIGURE 3 GRIP



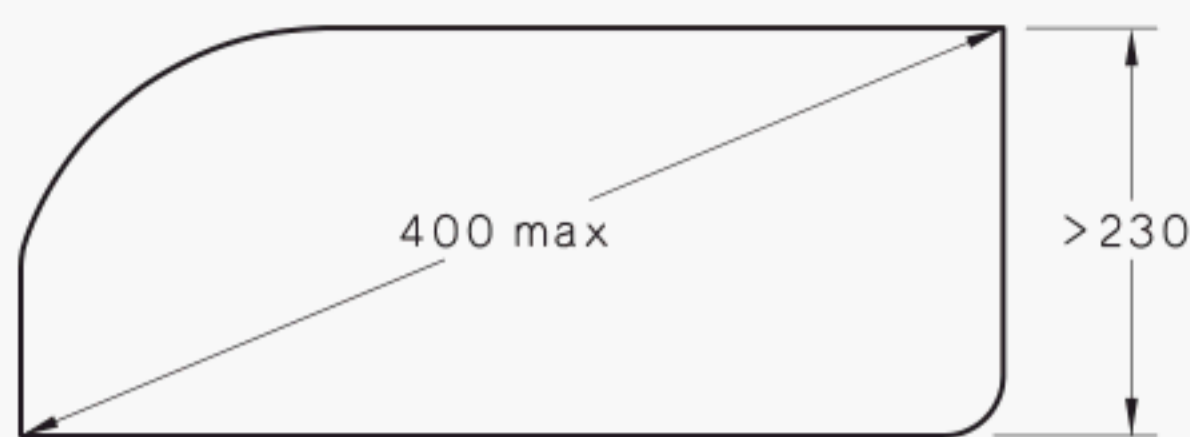
DIMENSIONS IN MILLIMETRES

FIGURE 4 DETAILS OF ACCESS, GUARDRAILS AND MATTRESS MARKER



DIMENSIONS IN MILLIMETRES

FIGURE 5 MATTRESS BASE—GUARDRAIL DIMENSION



DIMENSIONS IN MILLIMETRES

FIGURE 6 FALL-THROUGH HAZARD

6.5 Climbing access

6.5.1 General

A ladder, steps or other means of climbing shall be provided for any bunk bed in which the upper surface of the mattress base is more than 800 mm from the floor. The ladder shall be continuous, straight and either vertical, or sloping at an angle of not less than 65° from the horizontal. The climbing access shall lead to an opening in the guardrail as defined in Clause 6.4.2(b). At least one dimension of the stiles of a ladder, either thickness or depth, shall not exceed 45 mm (see Figure 3), to enable a child to firmly grip the stile.

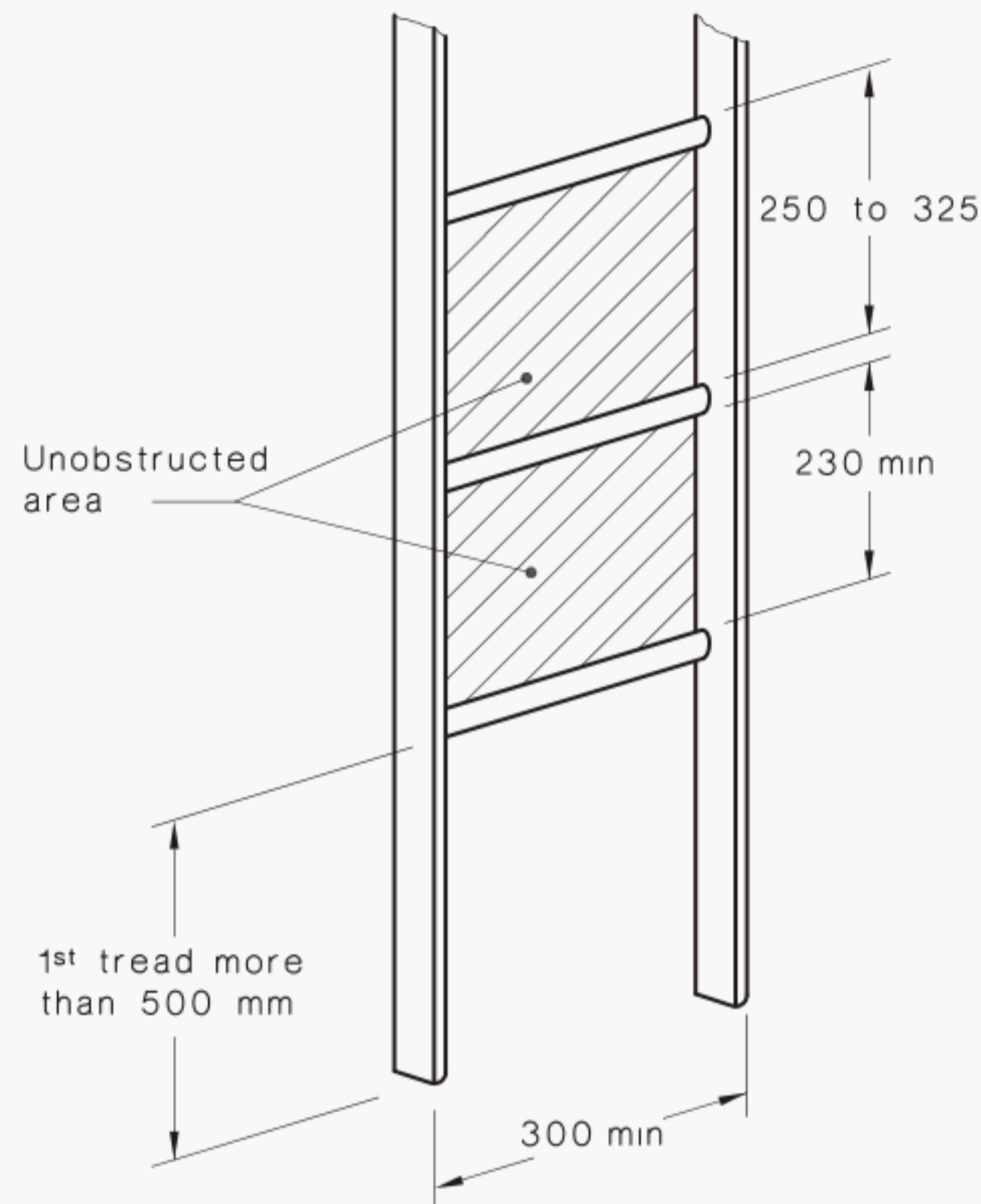
NOTE: The ladder may be an integral part of the bed construction.

6.5.2 Treads

Treads shall—

- (a) be spaced so that the upper surfaces of two successive treads shall be equally spaced within a tolerance of ± 20 mm;
- (b) be spaced so that the upper surfaces of two successive treads shall be within the range of 250–325 mm (see Figure 7);
- (c) be spaced so that the distance between the upper surface of the tread and the underside of the next tread above is at least 230 mm (see Figure 7);
- (d) be unobstructed within the space of the upper surface of a tread and the underside of the next tread above;
- (e) be spaced so that the unobstructed step depth is at least 90 mm and the space between the rear part of the tread and the frame component is between 50 mm and 95 mm or less than 30 mm;
- (f) be so designed that at least one dimension of the tread, either depth or thickness, shall not exceed 45 mm, to enable a child to firmly grasp the tread;
- (g) have a useable width of at least 300 mm (see Figure 7); and
- (h) be at least 500 mm above the floor.

NOTE: This Clause is intended to discourage young toddlers from attempting to climb the ladder.



DIMENSIONS IN MILLIMETRES

FIGURE 7 ACCESS DIMENSIONS

6.6 Tube end openings

All openings at the ends of tubes shall be suitably capped or plugged.

6.7 Sharp edges and sharp points

Exposed edges and protruding parts shall be chamfered and free of burrs, sharp points or sharp edges. When tested in accordance with AS/NZS ISO 8124.1, bunk beds shall have no sharp edges or sharp points within the cot.

6.8 Protrusions and snag points

Protrusions shall not be more than 5 mm unless they are so designed that they cannot snag onto clothing.

NOTES:

- 1 The intention of Clause 6.8 is to ensure that the inside of a bunk bed is free from protrusions which could injure an occupant (especially its head) if the occupant fell or rolled onto the protrusion.
- 2 The intention of Clause 6.8 is to ensure that protrusions and snag points on a bunk bed do not present a means on which the occupant's clothing could catch and thereby present a possible strangulation hazard.

7 SAFETY AND PERFORMANCE REQUIREMENTS

7.1 Entrapment hazard

Except as otherwise permitted in this Standard, all gaps 600 mm or more above the floor surface in a bunk bed shall, when tested in accordance with the appropriate steps in Appendix A, comply with the following:

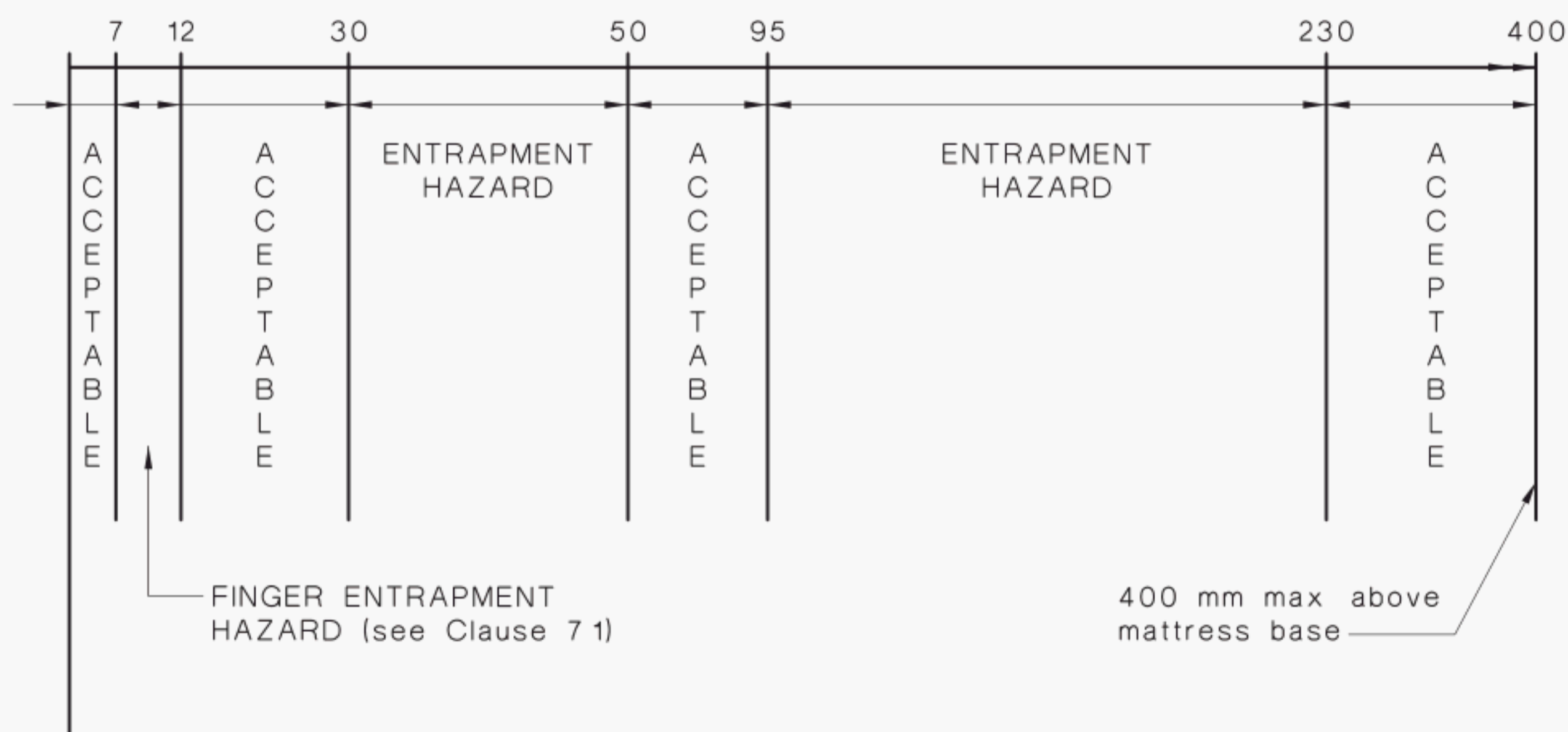
- (a) If any gap allows the passage of a 230 mm diameter probe, that gap shall not be of such a design that it has a reducing configuration which does not allow the removal of the probe through that reduced configuration (e.g. see Figure A1 and gap B in Figure 2).

NOTE: This is intended to apply to reducing configurations that will trap an individual.

- (b) If any gap, other than those complying with Item (a), allows the passage of a 50 mm diameter probe, that gap shall not allow the passage of a 95 mm diameter probe.
- (c) If any gap, other than those complying with Items (a) and (b), allows the passage of a 12 mm diameter probe, that gap shall not allow the passage of a 30 mm diameter probe.
- (d) If any gap other than those complying with Items (a), (b) and (c) allows the entry of a 7 mm diameter probe but does not allow entry of a 12 mm diameter probe, the depth of the entry of the 7 mm probe shall not be greater than 10 mm.

NOTES:

- 1 Figure 8 is a linear representation of gap sizes that pose entrapment hazards.
- 2 Finger entrapments should not exist on a bunk.
- 3 The dimension 600 mm above the floor surface is an accepted height above which if a child is entrapped by the neck, it is unlikely they are able to reach the floor surface with their feet. Hanging could result.



NOT TO SCALE
DIMENSIONS IN MILLIMETRES

FIGURE 8 LINEAR REPRESENTATION OF HAZARDOUS OPENINGS
APPLICABLE OVER 600 mm

7.2 Stability

When tested in accordance with Appendix B, no structural upright (e.g. corner post) shall lift off the floor.

7.3 Fastenings of upper bed to the lower supporting structure

When tested in accordance with Appendix C, a stackable bunk bed shall be so designed that—

- (a) the upper bed shall not separate from the lower bed in a manner that allows the upper bed to collapse onto the lower bed; and
- (b) any locking mechanism fastening the upper bed to the lower bed shall not disengage, break or become permanently deformed.

7.4 Fatigue test on joints

When tested in accordance with Appendix D, no joint shall become visibly damaged or detached.

7.5 Impact test

When tested in accordance with Appendix E, the bunk bed shall not fail or become permanently deformed nor shall any fastening device (e.g. a screw) or joint be damaged or detached.

7.6 Static load on guardrails

When tested in accordance with Appendix F, no guardrail shall fail, become detached, or become permanently deformed.

7.7 Impact load on guardrails

When tested in accordance with Appendix G, no guardrail shall become detached, permanently deformed or break.

7.8 Ladder attachment

When tested in accordance with Appendix H, the ladder shall not be displaced relative to the bunk bed and the ladder attachment means shall not become detached, permanently deformed, or break.

7.9 Static load on treads

When tested in accordance with Appendix I, no tread shall become detached, permanently deformed or break.

7.10 Impact load on treads

When tested in accordance with Appendix J, no tread shall become detached, permanently deformed or break.

8 INFORMATIVE LABELLING

Each bunk bed shall include the following information in a leaflet, or other printed material which is to be supplied with the bunk bed:

- (a) A list of the parts supplied and details of any tools required to assemble the bed.
- (b) Detailed diagrams showing how to assemble the bunk bed, including specific instructions pertaining to—
 - (i) bed end structures;
 - (ii) installation of foundation or support system for the mattress or springs;
 - (iii) fitting of the upper bunk to the lower bunk;

- (iv) attachment of guardrails; and
 - (v) attachment of ladders.
 - (c) A statement indicating that children under the age of 9 should not use an upper bunk or elevated bed suspended over a play area, furniture (e.g. a workstation or other feature).
- NOTE: Children under the age of 9 should not use the upper bunk due to the statistical chance of significant injury.
- (d) A statement that children should be discouraged from playing on the bunk bed.
 - (e) A statement that the bunk bed should be checked periodically to ensure that the guardrail, ladder and other components are maintained in the correct position and state of repair and that all connectors are tight.
 - (f) A warning as follows:
‘The upper bunk must be more than 2 m from any ceiling fan.’

9 MARKING

In addition to any marking required by Federal, State or Territory law, all bunk beds shall be permanently and prominently marked with the following information:

- (a) When required, see Clause 6.4.2(c), a distinct line, at least 150 mm in length on at least one side or end to indicate the maximum height of the mattress, together with the words **‘MAX. MATTRESS HEIGHT’**.
- (b) For bunk beds of Australian manufacture—
 - (i) the manufacturer’s or distributor’s name and address or the manufacturer’s trademark and address; and
 - (ii) a distinctive model name or model number and the month and year of manufacture such that the model can be identified for the purposes of recall.
- (c) For imported bunk beds—
 - (i) the country of origin;
 - (ii) the Australian distributor’s name and address; and
 - (iii) a distinctive model name or model number and the month and year of manufacture such that the model can be identified for the purposes of recall.
- (d) On upper bunks beds above 800 mm the following prominent warning notice shall be included:

<p>WARNING: TOP BUNKS ARE VERY DANGEROUS FOR CHILDREN UNDER 9.</p>

NOTE: Manufacturers making a statement of compliance with this Australian/New Zealand Standard on a product, packaging, or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

- (e) Labels shall show no detachment from the bunk and bunk bed, and the wording or labels either fixed to the product or on marking shall be easily legible when rubbed by hand for 15 seconds with a piece of cloth soaked with undiluted liquid domestic dishwashing detergent.

NOTE: In considering the durability of marking, the effect of normal use is taken into account. For example, marking with paint or enamel or other than vitreous enamel on a part that is likely to be cleaned frequently is not considered to be durable.

APPENDIX A
FALL-THROUGH AND ENTRAPMENT HAZARDS
(Normative)

A1 SCOPE

This Appendix sets out a method for testing a bunk bed for entrapment hazards posed by gaps.

NOTE: Clauses 6.4.2(d) and 7.1 specify the compliance requirements.

A2 PRINCIPLE

A series of probes are introduced into gaps and a force up to a maximum value is applied to the probes to ascertain whether the gaps pose entrapment hazards.

NOTES:

- 1 The test in this Appendix is intended to reduce the possibility of injury to the child by ensuring that there are no gaps within the bunk bed where any part of a child's body may become entrapped.
- 2 To simulate the strength of a child, a force of 100 N is applied to the probes to ascertain whether the gap being tested will open sufficiently to allow the probe to pass through.
- 3 Figure 8 illustrates a linear representation of gap sizes that pose entrapment hazards.

A3 APPARATUS

The following apparatus is required:

- (a) Two cylindrical test probes made of suitably rigid material with chamfered end, approximately 100 mm long and having the following diameters:
 - (i) 7 ± 0.1 mm.
 - (ii) 12 ± 0.1 mm.
 - (b) Four spherical probes made of suitably rigid material having the following diameters:
 - (i) 30 ± 0.5 mm.
 - (ii) 50 ± 0.5 mm.
 - (iii) 95 ± 0.5 mm.
 - (iv) 230 ± 0.5 mm.
- NOTE: Each probe may be mounted on a rod of suitable diameter for the purpose of applying the specified force.
- (c) A means of applying and measuring a force of up to 100 ± 2.5 N.

A4 TEST CONDITIONS

Immediately before testing, the bunk bed shall stand for at least 24 h in a standardized atmosphere at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

A5 PROCEDURE

The procedure shall be as follows:

- (a) If applicable, assemble the bunk bed in accordance with the manufacturer's instructions. Do not place a mattress on the mattress base of the bunk bed.

- (b) Identify all gaps which are accessible and 600 mm or more above the floor surface.
- (c) Note gaps formed within the guardrail as per Clause 6.4.2(d).
- (d) Ascertain whether there are any gaps that have a reducing configuration (e.g. see Figure A1 and gap B in Figure 2) allowing the passage of the 230 mm diameter probe (with the application of 100 N force, if necessary) but not allowing the removal of the probe (when a force of 100 N is applied) through any reduced configuration.

NOTE: If a gap of the above type is encountered then the bunk bed fails the entrapment requirements of Clause 7.1(a) and no further testing need be carried out.

- (e) Ascertain whether there are any gaps (other than those that allow the passage of the 230 mm diameter probe) that allow the passage of a 50 mm diameter probe (with the application of a 100 N force, if necessary) and also allow the passage of the 95 mm diameter probe (with the application of a 100 N force, if necessary).

NOTE: If a gap of the above type is encountered then the bunk bed fails the entrapment requirements of Clause 7.1(b) and no further testing needs to be carried out.

- (f) Ascertain whether there are any gaps (other than those that allow the passage of either a 230 mm or 50 mm diameter probe) that allow the passage of a 12 mm diameter probe (with the application of a 10 N force, if necessary) and also allow the passage of the 30 mm diameter probe (with the application of a 100 N force, if necessary).

NOTE: If a gap of the above type is encountered then the bunk bed fails the entrapment requirements of Clause 7.1(c) and no further testing needs to be carried out.

- (g) Ascertain whether there are any gaps or holes which allow the entry of a 7 mm diameter probe to a depth of greater than 10 mm, which do not allow the entry of the 12 mm probe.

NOTE: If a gap of the above type is encountered then the bunk bed fails the entrapment requirements of Clause 7.1(d) and no further testing needs to be carried out.

- (h) If possible, assemble the bunk bed in another arrangement, e.g. with the mattress base inverted and repeat Steps (b) to (g) for each possible assembly arrangement.

NOTE: The bunk bed is tested in all possible modes of assembly irrespective of whether the manufacturer intended it to be assembled in that mode, or whether the manufacturer provided a warning against incorrect assembly to ensure the bunk bed will perform satisfactorily under possible misuse.

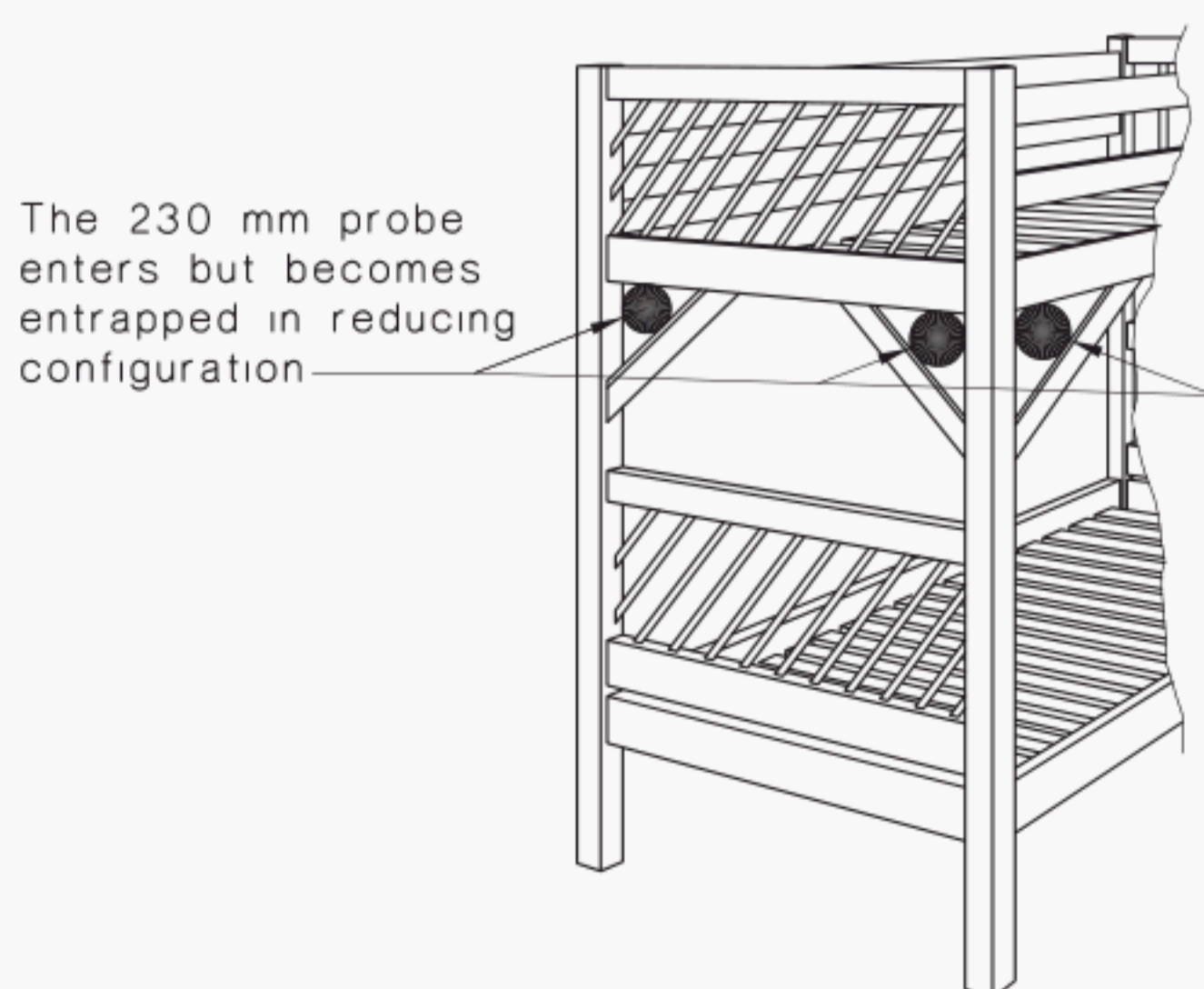


FIGURE A1 ARROWS SHOW GAPS WITH REDUCED CONFIGURATION

A6 REPORT

The following information shall be reported and, if appropriate, noted on a diagram of the bunk bed:

- (a) Gaps that failed the requirements of Clauses 6.4.2(d) and 7.1.
- (b) Reference to this test method, i.e. AS/NZS 4220, Appendix A.

APPENDIX B

STABILITY

(Normative)

B1 SCOPE

This Appendix sets out a method for testing the stability of a bunk bed when it is subjected to a horizontal force.

NOTE: Clause 7.2 specifies the compliance requirements.

B2 PRINCIPLE

A bunk bed is placed on a horizontal surface and its legs secured against suitable stops. A horizontal force is then applied to a specified location on the bunk bed in an attempt to tip it over.

B3 APPARATUS

The following apparatus is required:

- (a) Stops which will prevent the bunk bed from moving along the floor when the tip-over force is applied but which will not inhibit the bunk bed from tipping. The stops shall be no higher than 12 mm, except in cases where the design of the bunk bed necessitates the use of higher stops, in which case the stops shall be as low as will prevent the bunk bed from moving.
- (b) A 100 mm thick polyurethane mattress that complies with AS 2281 classification Type N, minimum density of 20 kg/m³ and nominal hardness of 100 ±15 N for each bed of the bunk.

B4 TEST CONDITIONS

Immediately before testing, the bunk bed shall stand for at least 24 h in a standardized atmosphere at a temperature of 23 ±2°C and a relative humidity of 50 ±5%.

B5 PROCEDURE

The procedure shall be as follows:

- (a) If applicable, assemble the bunk bed in accordance with the manufacturer's instructions.
- (b) Position the bunk bed on a solid level floor with the bottom of the structural uprights (e.g. corner posts) secured against the stops described in Paragraph B3(a).
- (c) Place the mattresses in the bunk bed.
- (d) Apply a horizontal force of 120 N to the highest point of the uppermost end or side guardrail which would most likely cause the bunk bed to tip over.
- (e) Observe if any structural uprights (e.g. corner posts) of the bunk bed lift off the floor.

B6 REPORT

The following information shall be reported, and if applicable, noted on a diagram:

- (a) Whether any of the corner posts of the bunk bed lifted off the floor during the test.
- (b) Which corner posts of the bunk bed lifted off the floor during the test.
- (c) Reference to this test method, i.e. AS/NZS 4220, Appendix B.

APPENDIX C

FASTENING OF UPPER BED TO THE SUPPORTING STRUCTURE

(Normative)

C1 SCOPE

This Appendix sets out a method for testing the integrity of the fastening of the upper bed to the lower bed of a stackable bunk bed.

NOTE: Clause 7.3 specifies the compliance requirements.

C2 PRINCIPLE

A specified vertical force is applied to the upper bed of a stackable bunk bed. The bunk bed is then observed to see if the upper bed separated from the lower bed.

C3 APPARATUS

The following apparatus is required:

- (a) A means of restraining the lower bed.
- (b) A suitable device capable of transmitting a vertical force of 125 ± 5 N.
- (c) A suitable time-measuring device.

C4 TEST CONDITIONS

Immediately before testing, the bunk bed shall stand for at least 24 h in a standardized atmosphere at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

C5 PROCEDURE

The procedure shall be as follows:

- (a) If applicable, assemble the bunk bed in accordance with the manufacturer's instructions ensuring that the locking mechanism fastens the upper bed to the lower bed. (The mattresses are not to be used in this test.)
- (b) Restrain the lower bed from lifting off the floor.
- (c) Apply a vertically upward force of 500 N for 30 s at a position on or near one of the structural uprights (e.g. bed posts) which would most likely disengage the upper bed from the lower bed.
- (d) If the upper bed does not disengage from the lower bed, repeat Step (c) separately for each remaining location on or near the structural upright (e.g. bed post) and for the mid-points between the structural uprights at each end of the bunk bed.
- (e) If the upper bed does disengage from the lower bed, support the weight of the disengaged upper bed and apply a horizontal force of 125 N for 30 s. With the horizontal force maintained, lower the disengaged upper bed and observe whether it will collapse onto the lower bed.

- (f) If the upper bed does disengage from the lower bed but it does not collapse (as observed in Step (e)) reassemble the bed in accordance with the manufacturer's instructions and repeat Step (c) separately for each remaining location on or near the structural upright (e.g. bed post).
- (g) If possible, assemble the bunk bed in another arrangement (e.g. the upper bed rotated horizontally through 180°) and repeat Steps (b) to (f).

C6 REPORT

The following information shall be reported, and if appropriate, noted on a diagram:

- (a) Whether the upper bed disengaged from the lower bed and collapsed onto the lower bed.
- (b) Whether any locking mechanism, fastening the upper bed to the lower bed disengaged, broke or became permanently deformed.
- (c) Reference to this test method, i.e. AS/NZS 4220, Appendix C.

APPENDIX D
FATIGUE TEST ON JOINTS
(Normative)

D1 SCOPE

This Appendix sets out a method for testing the integrity of the joints (e.g. between the bed posts and bed frame) on a bunk bed.

NOTE: Clause 7.4 specifies the compliance requirements.

D2 PRINCIPLE

A test load is positioned on a bunk bed and a horizontal push-pull force is applied to the corner of the bunk bed. This is repeated a specified number of times in both the longitudinal and lateral directions. The bunk bed is then examined for damaged or detached joints.

D3 APPARATUS

The following apparatus is required:

- (a) A means of restraining the lower bed.
- (b) A test mass of 75 kg capable of being distributed over an area that is approximately 300 mm in diameter.
- (c) A suitable time measuring device.
- (d) A means of applying horizontal forces of magnitude of 300 N to the application points on the bed defined in Figure D1 and in the sequence specified in Paragraph D5(d).

D4 TEST CONDITIONS

Immediately before testing, the bunk bed shall stand for at least 24 h in a standardized atmosphere at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

D5 PROCEDURE

The procedure shall be as follows:

- (a) If applicable, assemble the bunk bed in accordance with the manufacturer's instructions.
- (b) Restrain the bunk bed at the bottom of each structural upright (e.g. corner post).
- (c) Position the test mass specified in Paragraph D3(b), over an area that is approximately 300 mm in diameter in the centre of the upper bed.
- (d) Apply a push-then-pull force of 300 N (in each direction) to the upper bed (see Figure D1) along the—
 - (i) longitudinal direction A–B; and
 - (ii) lateral direction C–D.

The forces shall be applied level with the centre-line of the corner structure (see Figure D2) at a rate of approximately (but not more than) 24 cycles per min.

- (e) Repeat Step (d) for a total of 5000 times in each direction or until any joint becomes visibly damaged or detached.

- (f) Inspect each joint and, where necessary, tighten all consumer serviceable fasteners (e.g. nuts, screws, bolts) which may have loosened during testing.
- (g) Repeat Steps (d) and (e) for a further 5000 times in each direction.
- (h) Observe whether any joint became visibly damaged or detached.

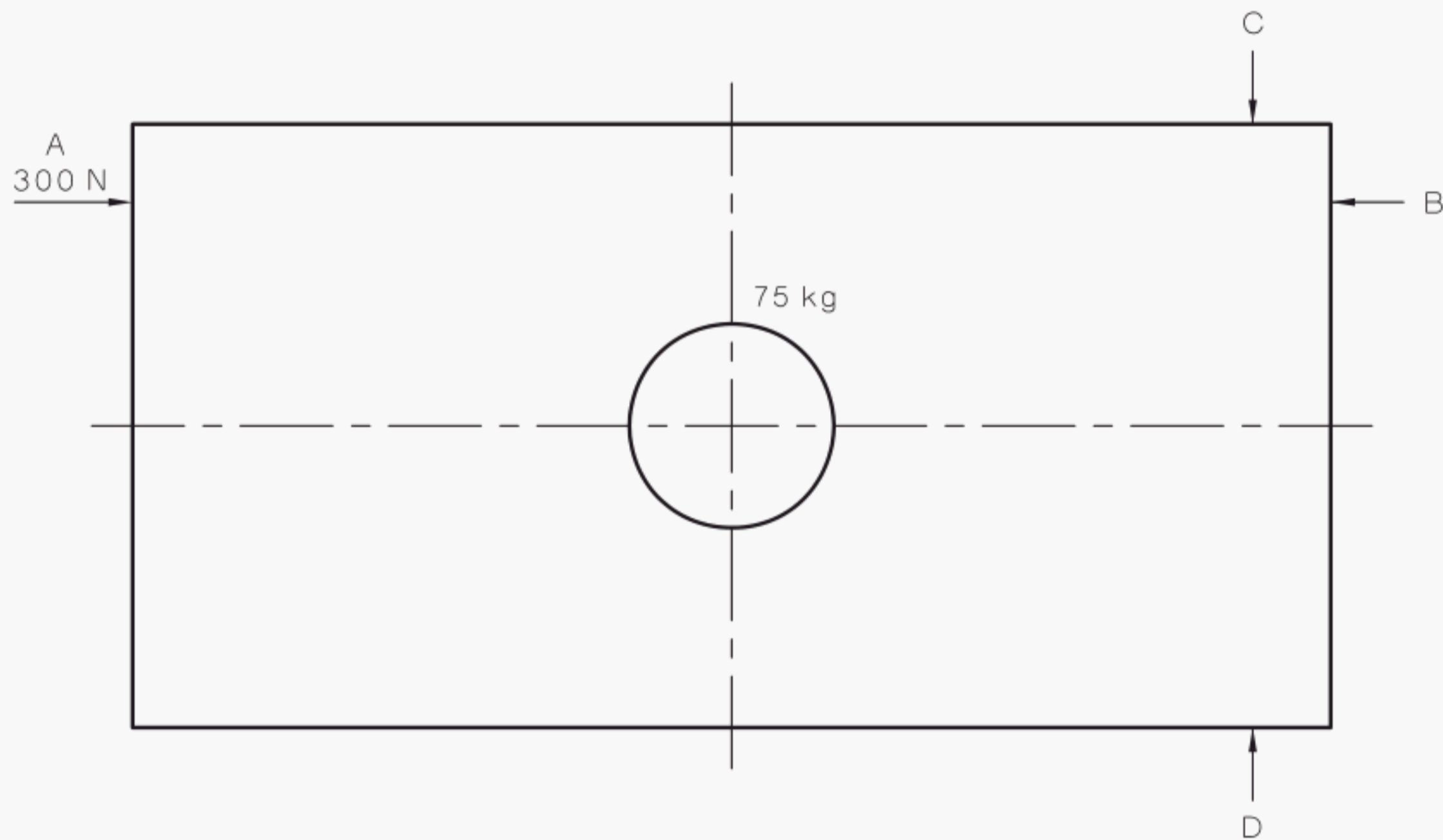


FIGURE D1 APPLICATION OF LOAD AND FORCES

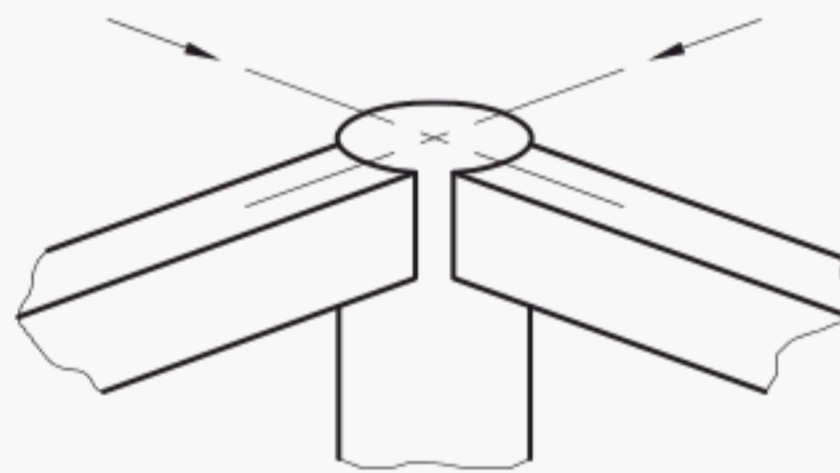


FIGURE D2 LOCATION OF POINTS FOR APPLICATION OF FORCES

D6 REPORT

The following information shall be reported and, if appropriate, noted on a diagram:

- (a) The number of times the force was applied before any joint was visibly damaged or became detached, up to and including 10 000 times in each direction.
- (b) Whether any joint became visibly damaged or detached.
- (c) Reference to this test method, i.e. AS/NZS 4220, Appendix D.

APPENDIX E
IMPACT TEST
(Normative)

E1 SCOPE

This Appendix sets out a method for testing the ability of a bunk bed (particularly the mattress base) to withstand repeated impacts.

NOTE: Clause 7.5 specifies the compliance requirements.

E2 PRINCIPLE

The mattress base (on which rests a mattress) is subjected to repeated impacts by freely dropping a specified weight from a specified height.

E3 APPARATUS

The following apparatus is required:

- (a) The test mattress specified in Paragraph B3(b), Appendix B.
- (b) A test weight that—
 - (i) is 300 mm in diameter;
 - (ii) has a flat contact face; and
 - (iii) has a mass of 30 ± 0.5 kg

NOTE: It is recommended that an automatic mechanical device be used to lift and drop the weight.

E4 TEST CONDITIONS

Immediately before testing, the bunk bed shall stand for at least 24 h in a standardized atmosphere at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

E5 PROCEDURE

The procedure shall be as follows:

- (a) If applicable, assemble the bunk bed in accordance with the manufacturer's instructions.
- (b) Place the mattress on the bunk bed.
- (c) Position the test weight so that—
 - (i) its contact face is 300 mm above the top of the mattress base; and
 - (ii) the centre of gravity of the test weight is located vertically above one of the impact positions (a to c) indicated in Figure E1.

Where there are options for selecting the actual impact location, (i.e. b has four locations, to choose from whilst c has two) the location selected shall be that location most likely to result in damage to the bunk bed. If such a location is not apparent, it shall be selected randomly.

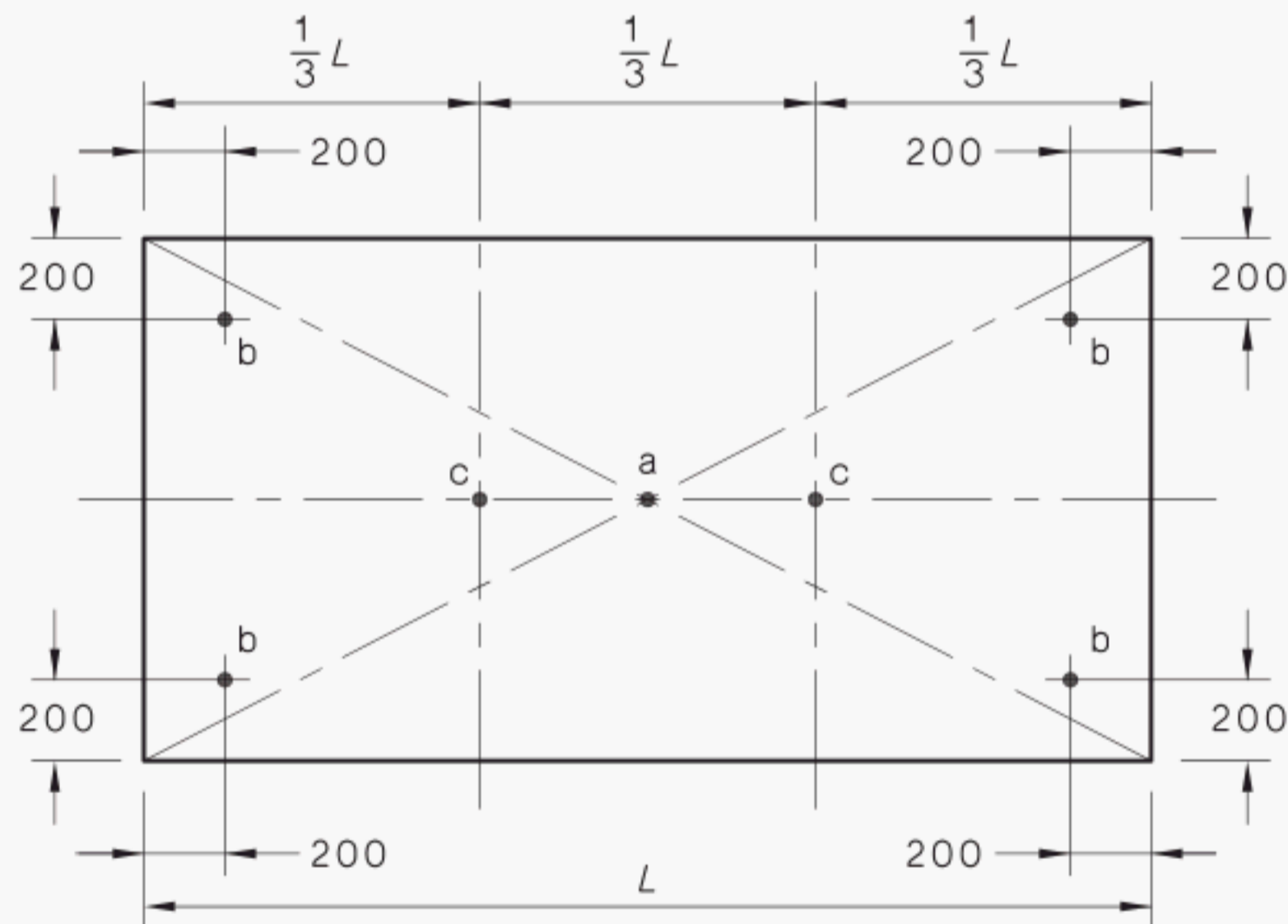
- (d) Release the test weight so that it falls freely onto the mattress.
- (e) Repeat Steps (c) and (d) until—

- (i) any component of the bunk bed fails or permanently deforms or any fastening device or joint loosens; or
- (ii) 30 drops have been completed for each of the three impact positions (i.e. a, b, c).
- (f) Inspect the bunk bed for failure, permanent deformation, or the loosening of any fastening device (e.g. screw) or joint.
- (g) If no failure, permanent deformation, loosening of any fastening device or joint is observed, or if the mattress base appears to have one or more apparent weak spots (other than at the locations illustrated in Figure E1), repeat Steps (c) to (d) for each of those weak spots.
- (h) Repeat Step (f).

E6 REPORT

The following information shall be reported and, if appropriate, noted on a diagram:

- (a) Whether any component of the bunk bed broke or became permanently deformed.
- (b) The number of times the weight was dropped before any component of the bunk bed failed or permanently deformed or any fastening device or joint loosened, up to and including 30 drops for each impact position.
- (c) Whether any fastening device (e.g. a screw) or joint was damaged or detached.
- (d) Reference to this test method, i.e. AS/NZS 4220, Appendix E.



DIMENSIONS IN MILLIMETRES

FIGURE E1 IMPACT POSITIONS

APPENDIX F
STATIC LOAD ON GUARDRAILS
(Normative)

F1 SCOPE

This Appendix sets out a method for testing the integrity of the guardrails when subjected to a static load.

NOTE: Clause 7.6 specifies the compliance requirements.

F2 PRINCIPLE

Specified horizontal and vertical forces are separately applied to specified locations on each of the guardrails to ensure that they do not loosen, become damaged, or break.

F3 APPARATUS

The following apparatus is required:

- (a) A means of restraining the bunk bed.
- (b) A suitable device or devices capable of transmitting forces of 240 ± 10 N and 500 ± 25 N.
- (c) Suitable time measuring device.

F4 TEST CONDITIONS

Immediately before testing, the bunk bed shall stand for at least 24 h in a standardized atmosphere at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

F5 PROCEDURE

The procedure shall be as follows:

- (a) If applicable, assemble the bunk bed in accordance with the manufacturer's instructions.
- (b) Restrain the bunk bed from sliding or lifting off the floor.
- (c) Apply separately, a horizontally *inward* force of 240 N for 30 s at—
 - (i) each end; and
 - (ii) the centre,at the mid-height of each guardrail.

NOTE: See Figure F1.

- (d) Apply separately, a horizontally *outward* force of 240 N for 30 s at—
 - (i) each end; and
 - (ii) the centre,at the mid-height of each guardrail.

NOTE: See Figure F1.

- (e) Apply separately, a vertically *downward* force of 500 N for 30 s at—
 - (i) each end; and

- (ii) the centre,
of each guardrail.

NOTE: See Figure F1.

- (f) Apply separately, a vertical upward force of 250 N for 30 s at—

- (i) each end; and
- (ii) the centre,
of each guardrail.

NOTE: See Figure F1.

- (g) Repeat Steps (a) to (f) 10 times for each location.

F6 REPORT

The following information shall be reported, and if appropriate, noted on a diagram:

- (a) Whether any of the guardrails failed, became detached or became permanently deformed at the application of the—
 - (i) horizontally *inward* force;
 - (ii) horizontally *outward* force;
 - (iii) vertically *downward* force; and
 - (iv) vertically *upward* force.
- (b) If applicable, the location where any of the guardrails failed, became detached or permanently deformed.
- (c) Reference to this test method, i.e. AS/NZS 4220, Appendix F.

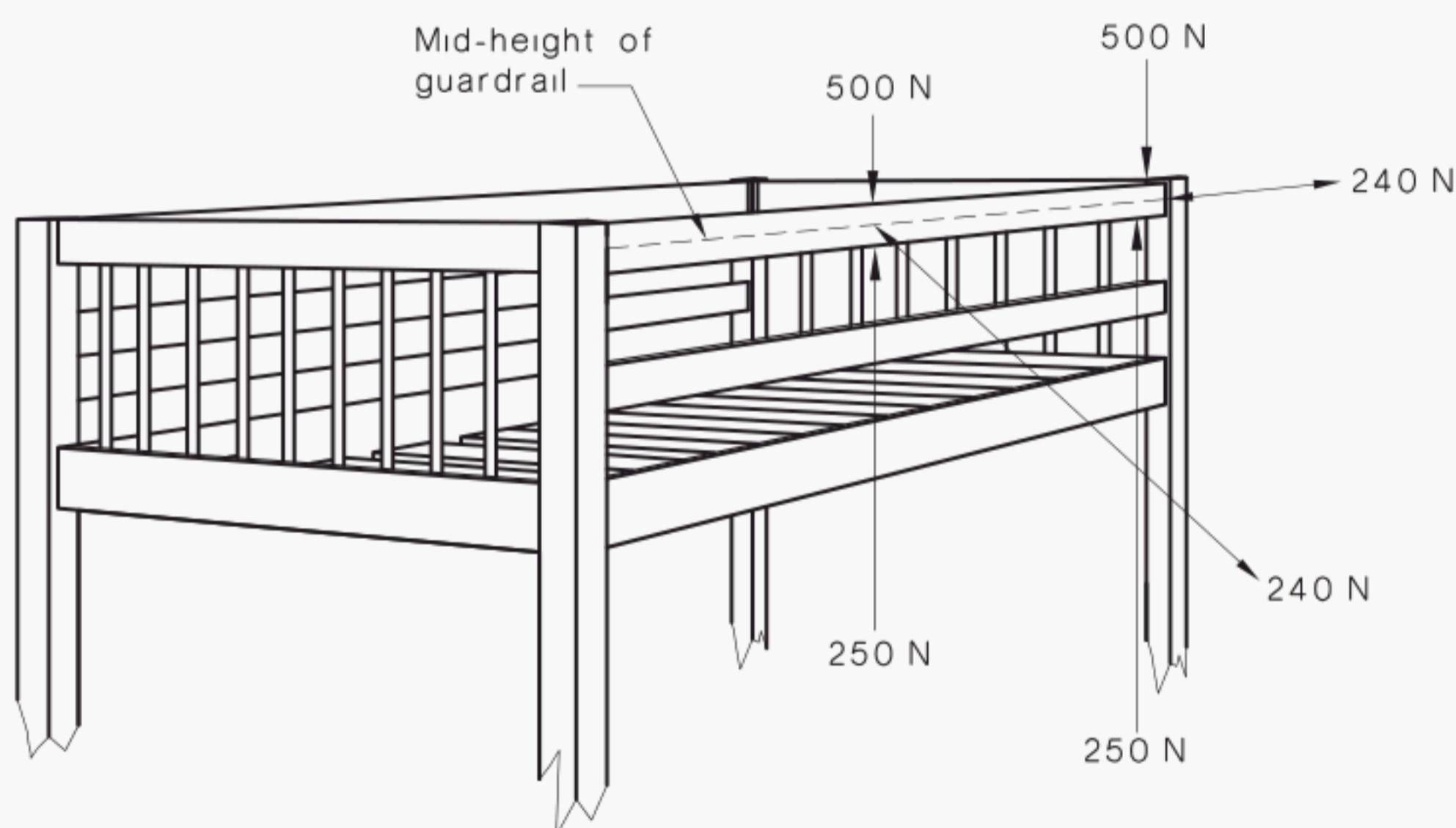


FIGURE F1 APPLICATION OF FORCE

APPENDIX G
IMPACT LOAD ON GUARDRAILS
(Normative)

G1 SCOPE

This Appendix sets out a method for testing the integrity of guardrails when subjected to an impact load.

NOTE: Clause 7.7 specifies the compliance requirements.

G2 PRINCIPLE

An impactor is allowed to swing a number of times from a specified height to strike each of the guardrails at specified locations. The guardrails are then examined for any detachment, permanent deformation or breakage.

G3 APPARATUS

The following apparatus is required:

- (a) A bunk bed restraining means.
- (b) An impactor (see Figure G1) comprising a basketball inflated to a pressure of 73.5 kPa and attached by a network of elastic cords to an annular seating. The annular seating shall be a ring of timber (or timber derivative) having an outside diameter of 150 mm with its front face shaped to fit the basketball.

The main body of the impactor shall include a mass supported by cords or flexible wire 850 mm long so that the longitude axis of the ball, mounting ring and main body assembly shall remain horizontal when the support cords are displaced from the vertical. The main body of the impactor shall be of such a mass that the total mass of all moving parts, excluding the support cords, shall be 50 kg.

- (c) A tape measure or other distance measuring means.

G4 TEST CONDITIONS

Immediately before testing, the bunk bed shall stand for at least 24 h in a standardized atmosphere at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

G5 PROCEDURE

The procedure shall be as follows:

- (a) If applicable, assemble the bunk bed in accordance with the manufacturer's instructions.
- (b) Restrain the bunk bed from sliding or tipping.
- (c) Position the impactor outside the bunk bed so that its longitudinal axis is at the mid-length and mid-height of one of the guardrails.
- (d) Swing the impactor through an angle of 18° to the vertical (i.e. so that its new longitudinal axis is 40 mm above its original position) (see Figure G1).
- (e) Release the impactor.
- (f) Repeat Steps (d) and (e) for a total of 10 impacts at that position.

- (g) Observe whether the guardrail broke, became detached or permanently deformed.
- (h) Repeat Steps (c) to (g) with the impactor positioned inside the bunk bed.
- (i) Repeat Steps (c) to (h) so that the impact location is—
 - (i) at each end (separately) of the guardrail; and
 - (ii) at the most onerous position of the guardrail.

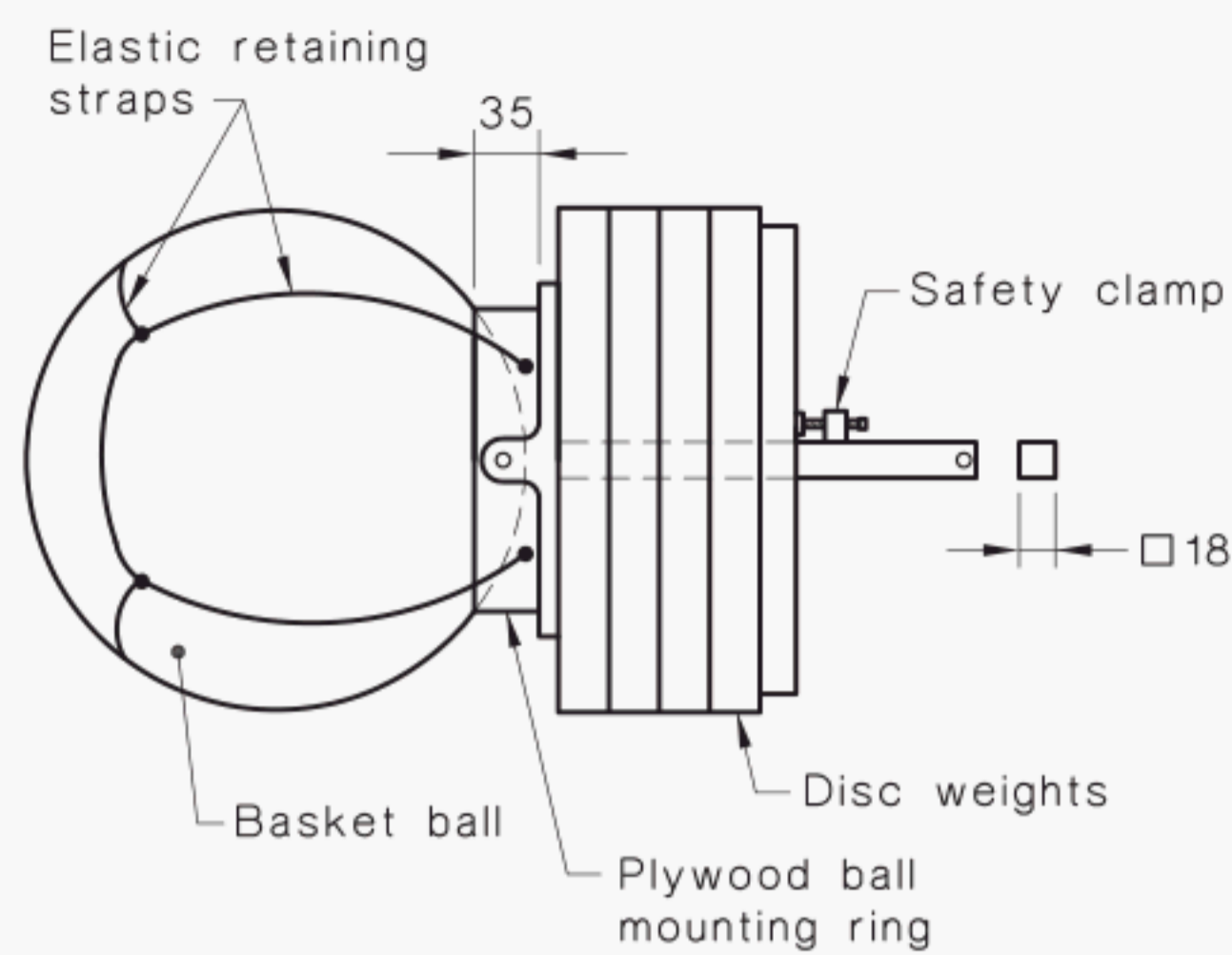
NOTES:

- 1 The positions noted above should be selected so that the impactor strikes the guardrail only and does not strike any other components of the bunk bed.
- 2 It may be necessary to move the guardrail.

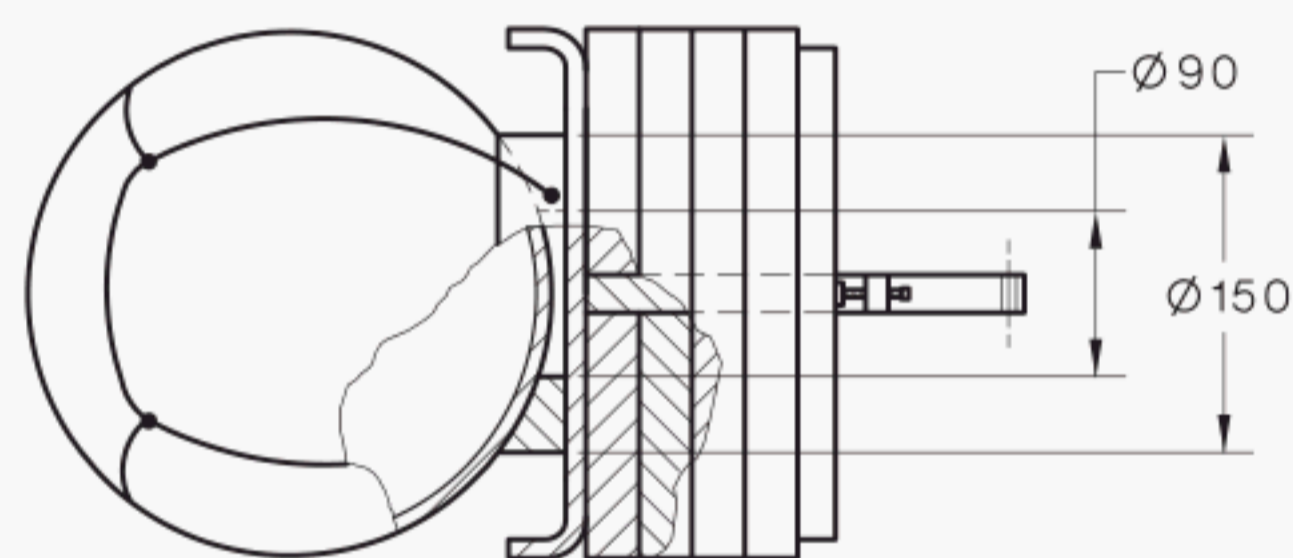
G6 REPORT

The following information shall be reported, and if appropriate, noted on a diagram:

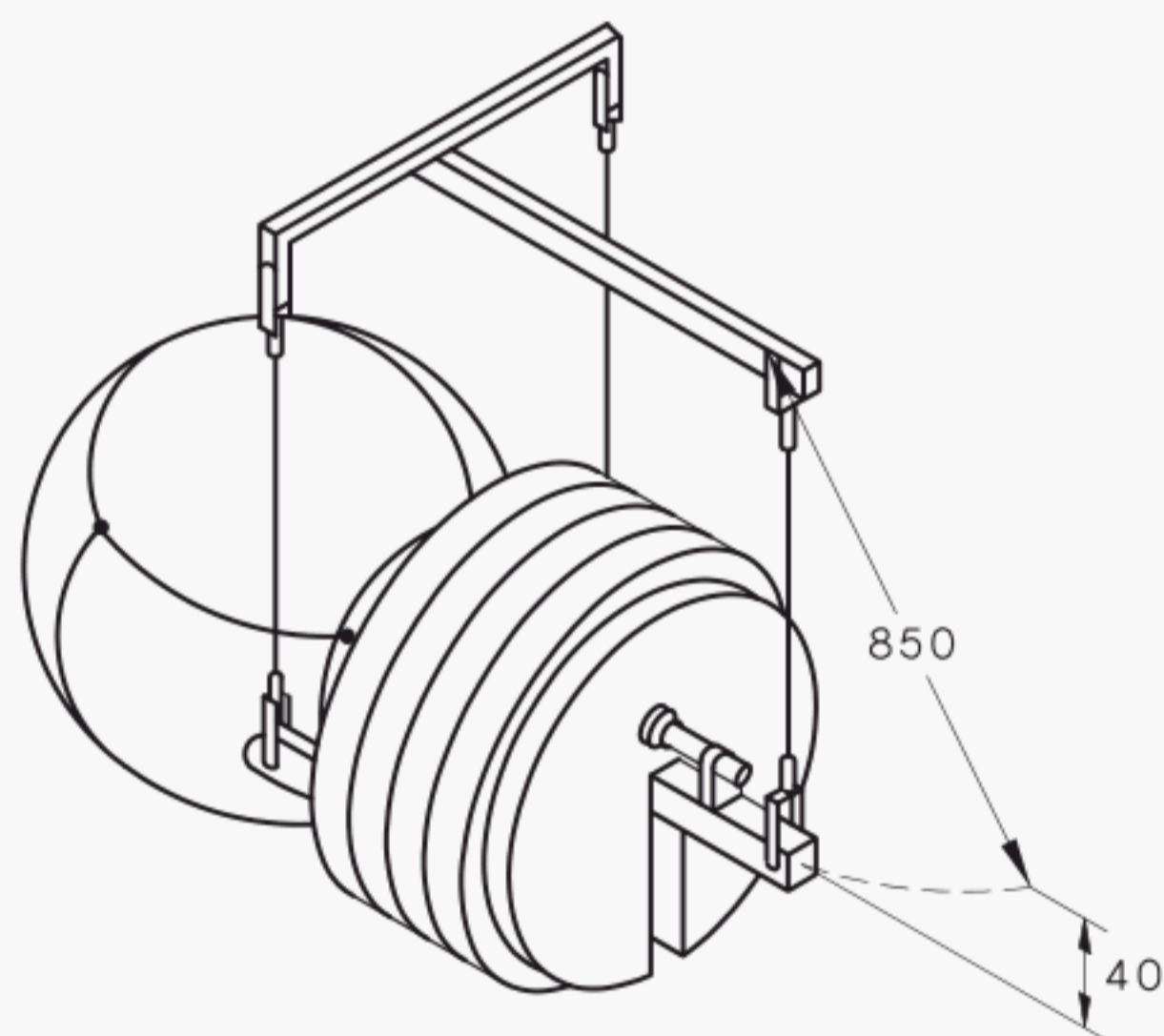
- (a) The locations struck by the impactor, if other than at the ends and mid-length.
- (b) Whether, and if applicable, the location of any guardrails that broke, became detached or permanently deformed.
- (c) Reference to this test method, i.e. AS/NZS 4220, Appendix G.



SIDE VIEW



TOP VIEW



DIMENSIONS IN MILLIMETRES

FIGURE G1 GUARDRAIL IMPACTOR

APPENDIX H

LADDER ATTACHMENT

(Normative)

H1 SCOPE

This Appendix sets out a method for testing the integrity of the ladder attachment means on a bunk bed.

NOTE: Clause 7.8 specifies the compliance requirements.

H2 PRINCIPLE

The ladder of a bunk bed is attached in accordance with the bunk bed manufacturer's instructions and specified forces are applied separately in an attempt to dislodge the ladder from its attachment position.

H3 APPARATUS

The following apparatus is required:

- (a) A bunk bed restraining means.
- (b) A means of applying a downward vertical force of two 500 ± 25 N forces over a length of 150 mm
- (c) A suitable device capable of transmitting a horizontal force of 500 ± 25 N.
- (d) A stopwatch or other suitable timing device.

H4 TEST CONDITIONS

Immediately before testing, the bunk bed shall stand for at least 24 h in a standardized atmosphere at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

H5 PROCEDURE

The procedure shall be as follows:

- (a) If applicable, assemble the bunk bed in accordance with the manufacturer's instructions, ensuring that the ladder is appropriately attached.
- (b) Restrain the bunk bed from moving.
- (c) Where there is an even number of treads, apply a vertically downward force (P) of 500 N to each of the two middle treads. Where there is an odd number of treads, apply a vertically downward force (P) of 1000 N to the middle tread (see Figure H1).
- (d) Sequentially (i.e. from 1 to 4 as illustrated in Figure H1) apply a horizontal force of 500 N for 1 min, at the top tread on each of the stringers of the ladder in the direction—
 - (i) away from the tread; and
 - (ii) away from the bunk bed.
- (e) Examine the ladder for any displacement relative to the bunk bed and the attachment means for any detachment, permanent deformation or breakage.
- (f) Remove all horizontal forces and apply a vertical upward force of 250 N for 1 min, at the centre of the top tread (see 5 in Figure H1).

- (g) Examine the ladder for any displacement relative to the bunk bed and the attachment means for any detachment, permanent deformation or breakage.

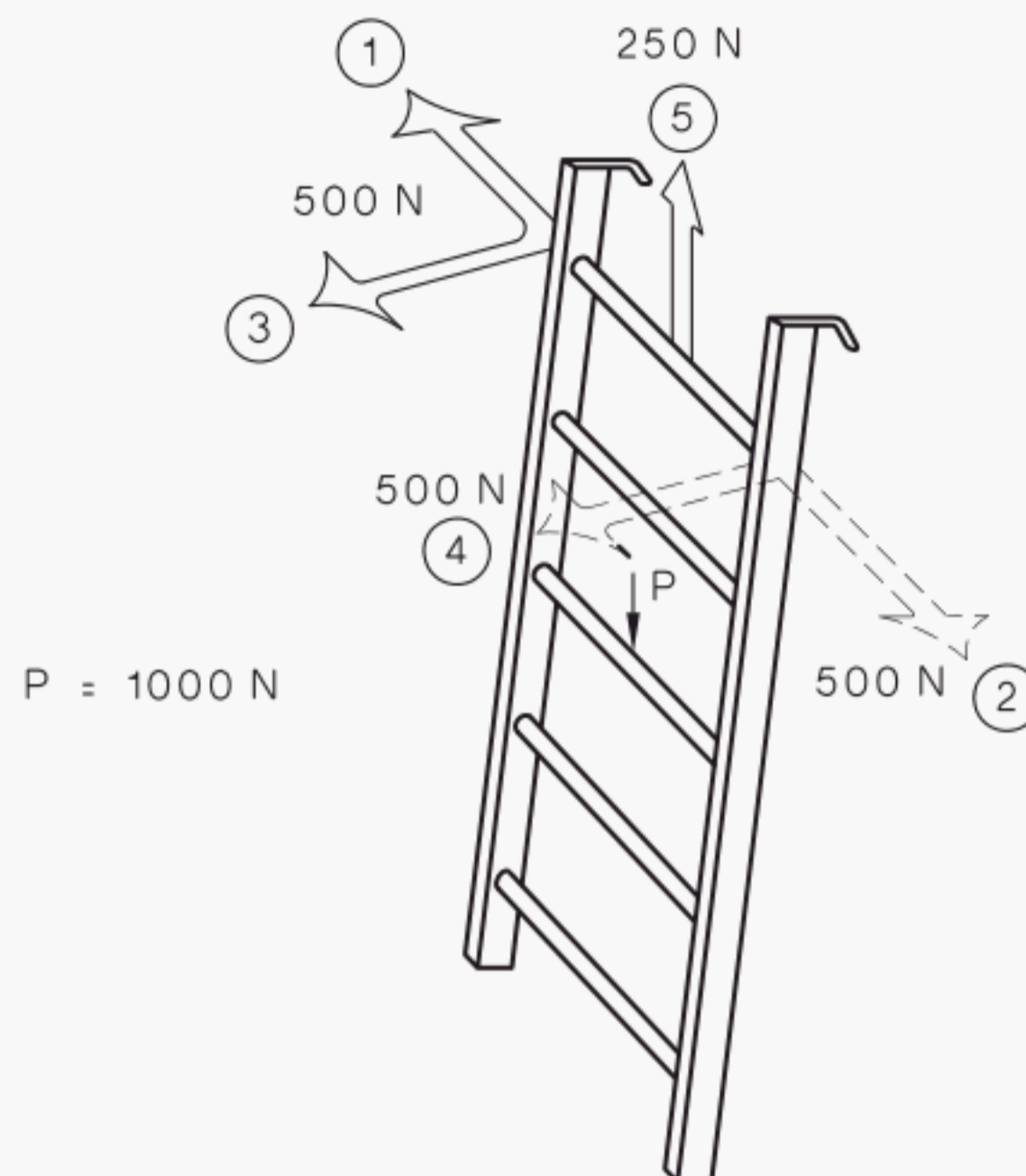


FIGURE H1 LADDER DISPLACEMENT FORCES

H6 REPORT

The following information shall be reported and if appropriate, noted on a diagram:

- (a) Whether the ladder became displaced relative to the bunk bed.
- (b) Whether the attachment means broke, became detached or permanently deformed.
- (c) Reference to this test method, i.e. AS/NZS 4220, Appendix H.

APPENDIX I
STATIC LOAD ON TREADS
(Normative)

I1 SCOPE

This Appendix sets out a method for testing the integrity of the treads of a ladder when these are subjected to a static load.

NOTE: Clause 7.9 specifies the compliance requirements.

I2 PRINCIPLE

A specified vertically downward force is applied for 30 s, to each tread of a ladder.

I3 APPARATUS

The following apparatus is required:

- (a) A means of restraining the bunk bed.
- (b) A device capable of applying a downward vertical force of 1500 ± 75 N.
- (c) A stopwatch or other suitable timing device.

I4 TEST CONDITIONS

Immediately before testing, the bunk bed shall stand for at least 24 h in a standardized atmosphere at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

I5 PROCEDURE

The procedure shall be as follows:

- (a) If applicable, assemble the bunk bed in accordance with the manufacturer's instructions, ensuring that the ladder is appropriately attached.
- (b) Restrain the bunk bed from moving.
- (c) Apply a vertically downward force of 1500 N evenly over a length of 150 mm, at the centre of each tread of the ladder. Maintain the force for 30 seconds.
- (d) Examine the ladder for any tread that broke, became detached or permanently deformed.

I6 REPORT

The following information shall be reported, and if appropriate, noted on a diagram:

- (a) Whether any tread broke, became detached or permanently deformed.
- (b) Which tread(s) broke, became detached or permanently deformed.
- (c) Reference to this test method, i.e. AS/NZS 4220, Appendix I.

APPENDIX J
IMPACT LOAD ON TREADS
(Normative)

J1 SCOPE

This Appendix sets out a method for testing the integrity of the treads of a ladder when these are subjected to an impact load.

NOTE: Clause 7.10 specifies the compliance requirements.

J2 PRINCIPLE

An impactor is allowed to fall from a specified height to strike nominated treads of a ladder. The treads are then examined for any detachment, permanent deformation or breakage.

J3 APPARATUS

The following apparatus is required:

- (a) A means of restraining the bunk bed.
- (b) An impactor (see Figure J1) consisting of a 1100 mm long steel tube having a nominal outside diameter of 25 mm and a wall thickness of approximately 2 mm. The mass of the tube is to be approximately 1.6 kg. The tube is to be freely pivoted at one end and on the other end is to be mounted an impact pad being a square steel plate measuring 100 mm × 100 mm and having a thickness of 6 mm and a total mass of 0.5 kg.

Disc weights having a mass of 15 kg shall be capable of being fastened onto an appropriate location, onto the tube.
- (c) A tape measure or other distance measuring means.

J4 TEST CONDITIONS

Immediately before testing, the bunk bed shall stand for at least 24 h in a standardized atmosphere at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$.

J5 PROCEDURE

The procedure shall be as follows:

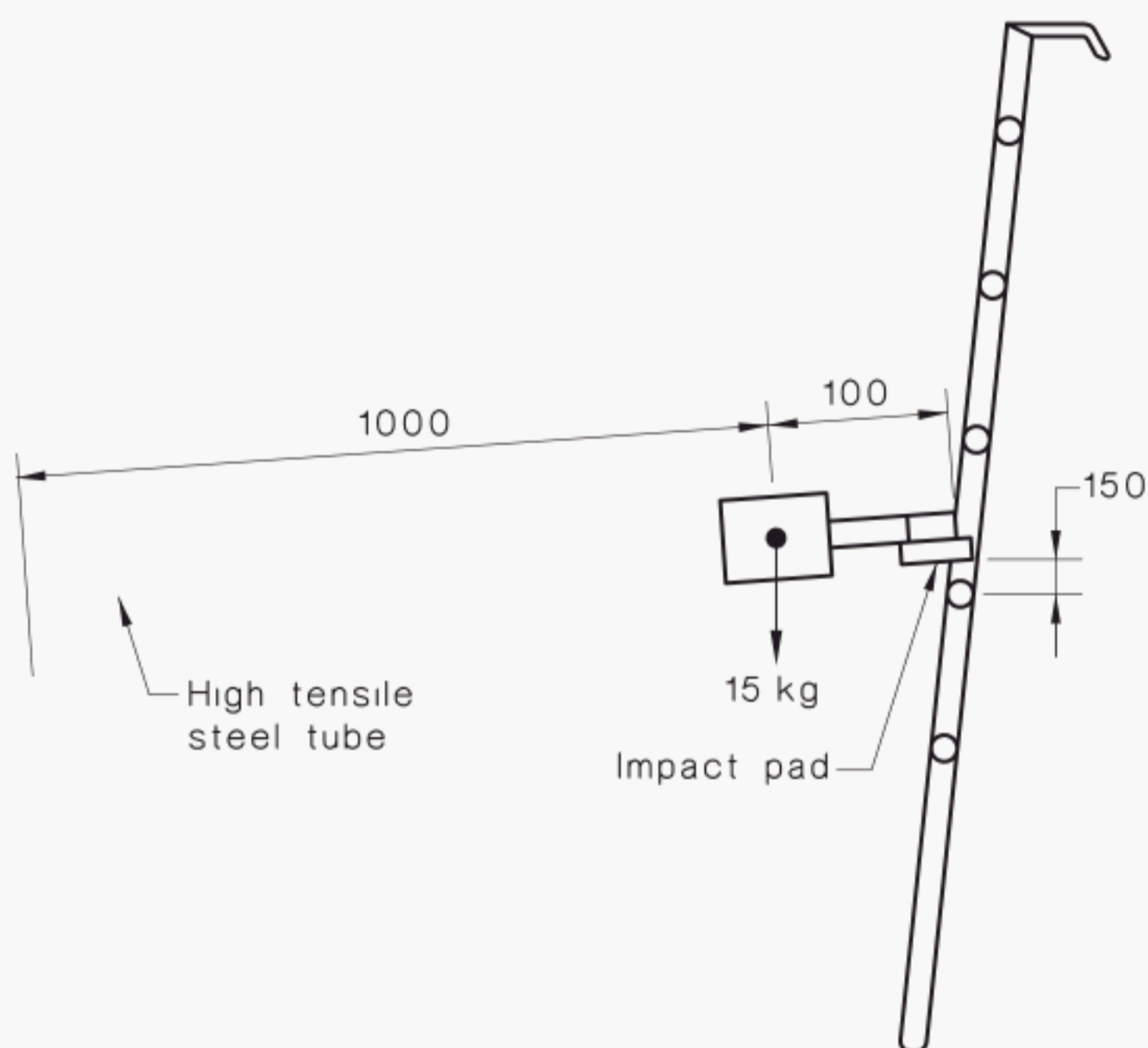
- (a) If applicable, assemble the bunk bed in accordance with the manufacturer's instructions, ensuring that the ladder is appropriately attached.
- (b) Restrain the bunk bed from sliding but not tipping.
- (c) Position and secure the disc weights onto the high tensile steel tube such that the centre of gravity of the weights is 100 mm from the centre of gravity of the impact pad.
- (d) Position the impactor so that the centre of gravity of the impact pad would strike the mid-length of the centre tread.
- (e) Raise the impactor so that the distance between the point of impact on the tread and the impacting surface of the impact pad is 150 mm.
- (f) Allow the impactor to fall onto the tread.

- (g) Repeat Steps (e) and (f) for a total of 10 impacts.
- (h) Observe whether the impacted tread broke, became detached or permanently deformed.
- (i) Repeat Steps (c) to (h) with the impactor positioned to strike the mid-length of—
 - (i) top tread;
 - (ii) bottom tread; and
 - (iii) the tread most likely to become detached, permanently deformed or break, if other than the mid, top or bottom tread.

J6 REPORT

The following information shall be reported, and if appropriate, noted on a diagram.

- (a) The locations struck by the impactor, if other than the mid, top, or bottom treads.
- (b) Whether any tread broke, became detached or permanently deformed.
- (c) Reference to this test method, i.e. AS/NZS 4220, Appendix J.



DIMENSIONS IN MILLIMETRES

FIGURE J1 TREAD IMPACT TESTER

NOTES

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